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RESEARCH

A Pilot Study of a Mindfulness-Based Cognitive Therapy for Internet Gaming Disorder Among College-Aged Students in South Korea

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Abstract

Objectives Mindfulness-based cognitive therapy (MBCT) integrates cognitive therapy and mindfulness meditation to help individuals disengage from maladaptive thoughts and reactive behavioral patterns. By cultivating nonjudgmental present-moment awareness and decentering from thoughts and emotions, MBCT enhances the capacity to respond more skillfully, thereby reducing impulsivity and promoting self-control. This study pilot-tested the effectiveness of MBCT for internet gaming disorder (MBCT-G) among college-aged students at risk for problematic gaming, focusing on reducing symptoms of internet gaming disorder and secondarily on psychological benefits.

Method A pilot experimental study was conducted in South Korea with 46 college-aged students at high risk of internet gaming disorder. The intervention group ($n = 24$) participated in eight group sessions of MBCT-G and a control group ($n = 22$) received no intervention. Internet gaming disorder, impulsivity, depressive symptoms, perceived stress, anxiety, and self-control were assessed before and after the intervention and at 4 weeks postintervention.

Results Linear mixed-model analyses indicated participants in the intervention group had greater reductions in internet gaming disorder symptoms, perceived stress, and state anxiety and enhanced improvement in self-control relative to the control group; these changes persisted at 4-week follow-up except for state anxiety.

Conclusions Findings suggested MBCT-G is a promising intervention for college-aged students whose gaming is problematic and puts them at risk for gaming disorder. Further research is needed with a larger sample, a comparison group receiving an alternative intervention and a longer follow-up period.

Preregistration This study was not prospectively registered; however, it was retrospectively registered with ISRCTN Registry (# ISRCTN17598517).

Keywords Mindfulness-based cognitive therapy · Internet gaming disorder · College-aged students · South Korea

The global gamer population reached approximately 3.32 billion in 2025, and approximately 38% were young adults between 18 and 34 years old (Exploding Topics, 2025). The rise of gaming popularity has produced new challenges in

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mental health, such as internet gaming disorder (IGD). Recognizing this challenging public health issue, the American Psychiatric Association included IGD in the fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* as a condition warranting further study (Borges et al., 2021; Zajac et al., 2020). IGD is characterized by "persistent and recurrent use of the Internet to engage in games, often with other players, leading to clinically significant impairment or distress" (American Psychiatric Association, 2022, p. 913).

Although adolescents often show somewhat higher prevalence of IGD (Paulus et al., 2018; Stevens et al., 2021), adolescents and young adults are often grouped together in epidemiological studies and consistently identified as high-risk populations for IGD (Kim et al., 2022a, b). A meta-analysis revealed IGD's pooled prevalence was much higher among adolescents and young adults (9.9%; Gao et al., 2022) than in the general adult population (6.7%; Zhou et al., 2024). College-aged students may be particularly vulnerable to IGD as a result of facing academic and career stress while also being free from parental control and surveillance which enable them to seek pleasure (Sussman & Arnett, 2014). College-aged students remain a clinically important group in which problematic gaming behaviors may become more persistent and functionally impairing, including increased risk for mental health problems and suicidal ideation (Benjet et al., 2023; Ohayon & Roberts, 2021; Orozco et al., 2024).

Compared to Western countries, IGD is a more serious social issue in Asian countries, where gaming is frequently used as a coping or escape mechanism for pervasive academic competition (Gu & Mao, 2023; Kang et al., 2016). In South Korea (hereafter Korea), the internet penetration rate in households reached 99.97% in 2024 (National Information Society Agency of Korea, 2025), and approximately 6% of the general population was classified as being at high risk of a gaming disorder (Korean Ministry of Health & Welfare 2021). Among all age groups, young adults aged 18–29 showed the highest prevalence at 18.3%, which was more than twice the rate observed in the 30–39 age group (9.0%; Korean Ministry of Health & Welfare, 2021). Another recent survey by the Korea Creative Content Agency (2024) reported that the rate of gaming among adults in their 20s was 85.1%, the highest among all age groups.

Moreover, in Korea, between 2011 and 2021, the Shutdown Law was implemented under the Youth Protection Revision Act, prohibiting children and adolescents younger than 16 from accessing online games between midnight and 6 a.m. nationwide (Kim et al., 2015). Although the mandatory shutdown was abolished in 2022, a Selective Shutdown System remains implemented, by which parents can control gaming hours for minors (Game Industry Promotion Act, 2025). In addition, adolescents in Korea experienced intense academic competition due to the highly competitive college entrance exam (Rudolf & Lee, 2023). Although college students experience relief from this stress, different stressors occur as they gain greater autonomy and reduced parental supervision, thus increasing their vulnerability to excessive gaming use. College-aged students in Korea, therefore, represent an appropriate population for investigating IGD and testing intervention strategies given that this group can offer both developmentally and policy-relevant insight into IGD.

Furthermore, young adults attending college enjoy greater autonomy and unstructured free time, while often facing new challenges including academic pressures and social stresses. Yet, they often have limited coping abilities and can experience difficulties adapting to a new learning environment (Byrd & McKinney, 2012; Cameron & Rideout, 2022). Emerging studies have substantiated that college students are at increased risk of developing IGD, due to the use of gaming as a coping strategy for managing the stressors inherent in transitioning to college life (Bin Abdulrahman et al., 2025; Gu & Mao, 2023; Malak et al., 2023). Thus, targeted interventions are particularly relevant in university settings, where students typically experience increased autonomy and are confronted with the need to exercise greater self-regulation as they transition from parental supervision.

Empirical studies have indicated that college students with IGD are more likely to experience significant psychological, behavioral, and social difficulties (Männikkö et al., 2015; Ohayon & Roberts, 2021). IGD has been associated with depressive symptoms (Ohayon & Roberts, 2021; Pitanupong et al., 2025), generalized and social anxiety (Ohayon & Roberts, 2021; Wang et al., 2017), elevated attention-deficit/hyperactivity disorder prevalence (Hawi & Samaha, 2024; Ko et al., 2024), high stress (Gu & Mao, 2023; Idris et al., 2023; Yen et al., 2019), and increased suicide risk (Orozco et al., 2024; Yu et al., 2024a, b). IGD also frequently co-occurs with substance use (Burkauskas et al., 2022; Di Carlo et al., 2023) and alcohol use disorder (Ko et al., 2024). These patterns of comorbidity have been linked to functional impairments such as academic impairment (Benjet et al., 2023; Bin Abdulrahman et al., 2025; Hawi & Samaha, 2024), poor social functioning and post-gaming conflicts (Benjet et al., 2023; Bin Abdulrahman et al., 2025), and elevated aggression and impulsivity (Hammad & Al-Shahrani, 2024).

In response to the growing prevalence of internet gaming and its adverse consequences, previous studies have reviewed the efficacy of various nonpharmacological interventions used to treat individuals with IGD, such as cognitive behavioral therapy (CBT; Y. Chen et al., 2023; Ock et al., 2025; Rajan et al., 2024; Reangsing et al., 2025; Seo et al., 2021) and family interventions (Nielsen et al., 2021; Rajan et al., 2024). However, these interventions showed limitations in that CBT appeared to be more effective in reducing IGD when delivered individually, which is resource-intensive (Reangsing et al., 2025). Moreover,

for college students who value autonomy and independence (LaFreniere, 2024), family intervention may not be a feasible and effective strategy to help them reduce IGD. These findings highlight a critical challenge for clinicians and mental health professionals in college settings, who have particularly constrained resources due to limited staffing and funding (Reangsing et al., 2025).

Mindfulness-based interventions have attracted attention for their success in reducing excessive gaming problems (Kim et al., 2022a, b; Li et al., 2017), because they may buffer psychological distress and IGD tendency (Wu et al., 2022). MBCT targets core change mechanisms that may be relevant to IGD in college students. Theoretically grounded in the integration of cognitive therapy and mindfulness meditation, MBCT helps individuals disengage from maladaptive rumination and reactive behavioral patterns by fostering nonjudgmental present-moment awareness, acceptance, attention control, and decentering (Dragland, 2015; Li et al., 2018; Segal et al., 2013; Teasdale et al., 2000). Given the potential relevance of core mindfulness theories to the treatment of IGD, shifting from reactive engagement with thoughts and urges to an observing stance may weaken the influence of cravings and emotional triggers underlying IGD by decreasing (a) brain responses implicated in executive control and gaming craving and (b) coupling between regions implicated in reward processing (Luo et al., 2025). Mindfulness has been found to reduce IGD severity and gaming-related cravings, potentially by modulating frontopallidal pathways linked to the prefrontal cortex, which are involved in self-control and decision-making (Ni et al., 2024).

For college students, who often face stressors such as academic pressure, social role transitions, and identity development, MBCT may help strengthen coping skills and self-control in contexts that typically trigger compulsive gaming as a coping mechanism (Bin Abdulrahman et al., 2025). This argument is supported by meta-analyses showing that mindfulness can increase cognitive regulation, decrease perseverative cognition and emotional arousal, and reduce attentional bias and subjective and physiological stress perceptions (Friese et al., 2012; Garland et al., 2014; Rosenthal et al., 2021). Studies have found that enhanced self-control or emotional regulation is associated with reduced risk of gaming and internet addiction (Song & Park, 2019; Tharumiya et al., 2026) and mediates the relationship between social isolation and IGD among university students (Guo et al., 2024).

Mindfulness-based cognitive therapy (MBCT) is an evidence-based intervention that is designed to be delivered in a group setting. Therefore, it is a cost-effective approach well-suited for college-aged students with IGD (Kabat-Zinn, 1990; Segal et al., 2013), who can learn from peers sharing similar challenges (First et al., 2018). In Kim et al. and's (2022a, b) study, combined CBT and mindfulness was shown to be effective in reducing IGD. CBT reduced excessive gaming, likely because of its use of cognitive restructuring and stimulus control techniques; while mindfulness helped college students enhance their ability to cope with negative affective states without resorting to gaming as an escape from stress or mental health challenges.

Although MBCT was originally developed and seen as effective in preventing relapse of depression (McCartney et al., 2021; Segal et al., 2013), MBCT was recently pilot-tested for its efficacy in reducing behavioral addictions, such as gaming (Melero Ventola et al., 2020) and smartphone addiction (Lan et al., 2018; Lei & Zhang, 2020). In addition, MBCT has been examined for its potential to reduce the severity of substance dependence (Ramezani et al., 2019). However, there remains a lack of extensive research on this evidence-based intervention in treating college-aged students with IGD. Further, current treatments for IGD have been limited by methodological flaws, such as lack of control groups, inconsistency of inclusion criteria, short duration, absence of standardized protocols and inadequate measurement, and little follow-up information on treatment adherence (Seo et al., 2021; Zajac et al., 2017). Furthermore, culturally, ethnically, and age-specific tailored interventions for Asian populations, such as Koreans, remain notably underdeveloped.

Thus, this study developed and pilot-tested the effectiveness of MBCT for college-aged students at high risk of IGD in Korea. This study hypothesized that MBCT-G would decrease the symptoms of IGD (primary hypothesis) and improve impulsivity, depressive symptoms, perceived stress, anxiety, and self-control (secondary hypothesis), as compared to a control group.

Method

Participants

Participants were recruited between December 2024 and January 2025 from 20 online communities that are exclusively open to college students by posting study announcements with the research team's contact information. The announcements were also sent to research participants of the principal investigator's previous qualitative study on gaming disorders who had agreed to be contacted about follow-up studies. Inclusion criteria were college or university students aged 19 to 24 years at high risk of IGD. Exclusion criteria included individuals with a history of psychosis, intellectual disabilities (intelligence quotient of 70 or less), or risk of suicide attempts.

Initially, 58 students were recruited and screened for initial eligibility with a 5-min online screening questionnaire

to assess inclusion and exclusion criteria (i.e., risk of IGD, suicidal behaviors, intellectual disabilities, and mindfulness experiences). Those who scored 10 or greater on the Internet Game Use-Elicited Symptom Screen (Jo et al., 2018), which consists of nine questions based on the *Diagnostic and Statistical Manual of Mental Disorders* (5th edition; American Psychiatric Association, 2013), were identified as having a high risk of IGD.

Additionally, the modified Korean version of the Suicidal Behaviors Questionnaire-Revised was employed to identify the risk of future suicide attempts. Seven participants were identified as being at risk of suicide attempts. The first author conducted in-depth interviews lasting 20 to 30 min using a risk assessment and management protocol (Linehan, 1981), and none were found to be at high risk of future suicide attempts or behaviors. Participants were excluded if they had participated in more than six sessions of mindfulness training in the last year to avoid potential contamination of the intervention's effects.

Procedure

This study developed and implemented MBCT-G with college-aged students at high risk of IGD, from January to June 2025 at the university affiliated with the principal investigator located in Seoul, the capital city of South Korea. The study involved measures at three time points: pretest, posttest, and 1-month follow-up. All participants provided verbal and written consent after being informed about the purpose of the study, compliance, compensation for participation, and the option to withdraw from participation. Data were collected at baseline before the intervention (T0), after the eight intervention sessions (T1), and 4 weeks after termination of the intervention (T2). Each participant received compensation for their participation after the completion of the follow-up assessment.

Participants were randomly assigned to the MBCT-G intervention ($n = 24$) or a control group ($n = 22$), which received no intervention, using Microsoft Excel software to generate a list of random numbers. Randomization was performed by a research team member, but the principal investigator who conducted the intervention was blinded to participants' group assignments. When recruiting participants, it was announced that those assigned to the intervention group must attend eight sessions, with the schedule provided in advance. Participants were blinded to the study hypotheses.

Participants in the intervention group attended 8 weekly face-to-face MBCT-G group sessions, delivered by the first author, a trained and qualified MBCT practitioner and social work professor. The control group did not receive any intervention. The protocol for the MBCT-G intervention was adapted from the Oxford University manual, *Mindfulness-Based Cognitive Therapy for Life* (MBCT-L; Bernard et al., 2020), developed to address depression, with 2-h sessions and about 40 min of formal home practice per day. The interdisciplinary research team modified this intervention to address symptoms of IGD, considering the characteristics of this population, who generally have challenges with attention, impulsivity, self-control, social interaction, time spent playing computer games, and participation in activities other than gaming (Hyun et al., 2015; Karaca et al., 2020; Kaya & Pazarcıkcı, 2023; Rho et al., 2018; Severo et al., 2020).

The objectives of the modified intervention were to develop more awareness of the unhelpful patterns of internet gaming by enhancing attention control and engagement in pleasurable and meaningful activities other than gaming, decentering unhelpful ways of reactivity, responding to difficulties skillfully, learning social skills and self-care strategies, and cultivating patience, kindness, and compassion. The program formats and components were adapted to the characteristics of the target population—such as craving, short attention spans, impulsivity, leisure boredom, and preference for immediate gratification (Chen et al., 2021; Deng et al., 2017; Li et al., 2021; Mehroof & Griffiths, 2010)—while maintaining the core principles of mindfulness-based interventions (Loucks et al., 2022). This modified manual adapted all terminology and case scenarios to the context of college-aged students at high risk of IGD. Each session lasted 90 min, along with about 30 min of formalized mindfulness home practice. Home practice assignments were shortened and adapted to the context of participants' IGD to enhance feasibility and relevance.

As shown in Table 1, this intervention involved the following eight session themes: (a) waking up from autopilot, (b) another way of being: keeping the body in mind, (c) gathering the scattered mind, (d) recognizing reactivity, (e) allowing and letting be, (f) responding skillfully to realize that thoughts are not facts, (g) how can I take care of myself, and (h) mindfulness of life (Bernard et al., 2020; Feldman & Kuyken, 2019). To address participants' idiosyncratic vulnerabilities, beginning in Session 2, participants were guided to employ an impulsive gaming calendar. From Session 2 onward, participants were instructed to use an alternative pleasant experiences calendar to support the incorporation of enjoyable daily activities unrelated to gaming. To help all participants adhere to the intervention protocol, they were asked to submit an online home practice form and monitor their average time spent gaming weekly. Participants also received mindfulness-related self-help books based on their attendance and home practice. The trainer sent a weekly letter summarizing the session themes, core mindfulness activities, and home practice to assist the participants with generalizing their learning to everyday life. To prevent attrition, the research team contacted the participants weekly via phone in addition to a reminder call the day before each session.

Table 1 Summary of MBCT-G sessions for college-aged students at high risk of internet gaming disorder

	Session	Key learning	Content
1	Waking up from automatic pilot	Awareness of automatic pilot Attentional control Attitudinal dimensions of mindfulness	Welcome, orientation to MBCT, raising practice, body scan, ten finger gratitude practice, setting home practice
2	Another way of being: keeping the body in mind	Another way of knowing experientially How the mind creates meaning Aware of personal impulsivity	Body scan, keeping the body in mind when listening and speaking (50:5 attention), home practice review, thoughts and feelings exercise (gaming scenarios), impulsive gaming calendar, ten minutes spent sitting with the breath, setting home practice
3	Gathering the scattered mind	Attention control and "coming home" through mindfulness practice Bringing mindfulness into everyday life Adding alternative pleasant experiences to everyday life	Body stretching practice, home practice review, three steps breathing space, sitting with breath and body, introducing alternative pleasant experiences calendar, setting home practice
4	Recognizing reactivity	Recognizing and allowing reactivity Learning experientially how maintenance cycles play out	Seeing and hearing practice, home practice review, review alternative pleasant experiences calendar, recognizing reactivity: the vicious flower, three steps breathing space for self-compassion, mindful walking, setting up home practice
5	Allowing and letting be	Developing stability and spaciousness Disempowering reactivity using allowing and befriending	Sitting with difficulty practice, home practice review, review alternative pleasant experiences calendar, pros and cons of allowing and letting be, breathing space: many faces, compassionate befriending practice, setting up home practice
6	Responding skillfully: thoughts are not facts	Responding with discernment and skillfulness Learning how mood creates viewpoints	Setting practice: breath, body, sounds, thoughts and feelings (opening to the pleasant), home practice review, reviewing alternative pleasant experiences calendar, moods, thoughts, alternative viewpoints exercise, responding very skillfully, setting up home practice
7	How can I best take care of myself?	Taking skillful action in the face of challenge, nourishing the self and cultivating joy and flourishing	Sitting practice: body and breath, relationship with experience, home practice review, review of alternative pleasant experiences calendar, nourishing or depleting rebalancing; pleasure or accomplishment list, three steps to breathing space and action, setting up home practice
8	Mindfulness of life	Review of the course Planning for ongoing practice	Body scan, home practice, review, alternative pleasant experiences calendar review, course review and personal reflections questionnaire, maintaining and sustaining practice – resources

The fidelity of the intervention was evaluated using the following approaches. First, the research team modified the MBCT-G manual in consultation with one of the original developers of MBCT-L, Willem Kuyken, who initially advised on principles for extending its utility to college students with IGD. This process included adapting the manual to address the specific characteristics of the target population. Second, the MBCT-G instructor was the first author, who had received formal MBCT-L training from one of its original developers at the University of Oxford. The instructor implemented the teaching manual, employing the principles of adaptation for mindfulness-based interventions as taught by the original developers. The instructor followed a structured, modified manual that specified session duration, in-session practice components, and home practice assignments.

After each training session, three research assistants provided feedback and cross-checked the extent to which the instructor adhered to the MBCT-G manual. Third, the research team sought consultation on developing a manual

suitable for this experimental study, ensuring that participants would not be contaminated across experimental and control groups, while maintaining fidelity to the core principles of experimental methodology. For example, participants were explicitly advised not to disclose intervention content to others outside their assigned condition. Moreover, the waitlist control group was organized in a manner that prevented any physical encounters or concurrent participation with members of the experimental group. Finally, all MBCT-G sessions were audio recorded, and the instructor reviewed them against the instructor manual to ensure adherence to the core principles of MBCT-G.

Measures

The primary and secondary outcomes were measured via an online platform using the following instruments. The intervention group completed surveys before, at the end of, and 4 weeks after the 8-week intervention. The control group followed the same pattern, completing surveys at enrollment in the study, 8 weeks later, and then 4 weeks after the second survey point.

Primary Outcome: Internet Gaming Disorder

To assess participants' IGD, this study used the Korean version of the Internet Gaming Disorder-20 (Pontes et al., 2014), validated by Kim (2019). This scale was developed based on nine criteria for diagnosing IGD suggested by the *Diagnostic and Statistical Manual of Mental Disorders* and consists of six subfactors (salience, mood modification, tolerance, withdrawal, conflict, and relapse). This self-report scale, consisting of a total of 20 items, features a 5-point Likert scale (1 = *not at all*, 5 = *strongly agree*). Total scores range from 20 to 100, with higher scores indicating a greater level of IGD symptoms. A cutoff point of 71 or higher indicates classification in the IGD risk group. Cronbach's alpha coefficient of the original version of the scale was reported as 0.88; in this study, it was 0.75.

Secondary Outcomes

Impulsivity The Korean version of the Short UPPS-P Impulsive Behavior Scale (Cyders et al., 2014), validated by Lim and Kim (2018), was used to assess participants' impulsivity. This self-report scale consists of 20 items with five subscales: positive urgency, negative urgency, lack of premeditation, lack of perseverance, and sensation seeking. It features a 4-point Likert scale (1 = *strongly agree*, 4 = *strongly disagree*) and the total score ranges between 20 and 80, with higher scores indicating higher levels of impulsivity. Cronbach's alpha for the original version was found to be 0.65–0.78 in Lim and Kim's (2018) study; it was 0.78 in this study.

Depressive Symptoms The Korean version of the Center for Epidemiologic Studies Depression Scale-Revised was assessed in this study to measure participants' depressive symptoms experienced during the past week. It consists of 20 items originally developed by Eaton et al. (2004) and has been modified and validated in Korean by Lee et al. (2016). Responses were scored on a 5-point Likert scale (0 = *rarely or none of the time*, *4* = *most or almost all of the time*) and the total scores range from 0 to 80, with higher scores indicating higher levels of depressive symptoms. The cutoff point is 16 for the original scale, but the optimal cut point suggested by Lee et al. (2016) is 13. Cronbach's alpha was 0.98 in the Lee et al. (2016) study and 0.91 in this study.

Perceived Stress The Perceived Stress Scale, a 10-item scale validated in Korean by Park and Seo (2010) based on the 14-item scale developed by Cohen et al. (1983), was used to assess participants' perceived stress. This scale employs a 5-point Likert scale (0 = *not at all*, 4 = *very often*), and a higher score indicates higher stress. Cronbach's alpha was reported as 0.74–0.77 by Park and Seo (2010) and was 0.79 in this study.

Anxiety The Korean version of the State-Trait Anxiety Inventory (Spielberger et al., 1970), validated in Korean by Kim and Shin (1978), was used to assess participants' anxiety. This scale consists of 40 items and measures state anxiety (20 items assessing temporary anxiety felt in the moment) and trait anxiety (20 items assessing anxiety felt in general). This scale uses a 4-point Likert scale (1 = *not at all*, 4 = *very much*) with a total score range of 20 to 80, whereby higher scores indicate higher levels of anxiety. Kim and Shin (1978) found Cronbach's alpha for state and trait anxiety to be 0.87 and 0.86, respectively; in this study, they were 0.92 and 0.87, respectively.

Self-control The Korean version of the Brief Self Control Scale (Tangney et al., 2004), validated in Korean by Hong et al. (2012), was used. It used a 5-point Likert scale (1 = *not at all*, 5 = *strongly agree*), with a total score ranging from 11 to 55. Higher scores indicate higher levels of self-control. Cronbach's alpha for the original Korean version was 0.78, and in this study, it was 0.86.

Demographics and Gaming-Related Information

Participants' demographic information, including age, sex, major, marital status, and employment, and gaming-related information, including game type, platform, and weekly time spent gaming, was assessed.

Data Analyses

Preliminary data analyses were performed in SPSS version 27. To describe the participants' characteristics, means and standard deviations for continuous data and frequencies and percentages for categorical data were used. Comparisons of characteristics between the groups at pretest were conducted using independent samples *t* tests for continuous variables and Mann-Whitney *U* tests for categorical variables. Statistical significance was set at $p < 0.05$ (two-sided). To evaluate the differences between the MBCT-G intervention and control groups on the outcome measures over time (T0, T1, and T2), linear mixed models (LMMs) with random intercepts were employed. LMMs allow inclusion of all available data under the assumption of missing at random, thereby accommodating missing observations without listwise deletion.

Fixed effects included group (intervention vs. control), time (T0, T1, and T2), and their interaction (group by time). The interaction terms allowed us to test whether changes over time differed between the intervention and control groups. Random effects accounted for the individual variability in intercepts across participants. Model estimation (Nguyen, 2020) was performed using restricted maximum likelihood. Model comparisons were based on likelihood ratio tests, and effect sizes were derived from estimated marginal means (Gelman & Hill, 2006).

Hedges' *g* (small-sample corrected standardized mean differences; Hedges & Olkin, 1985) for the group-by-time difference-in-differences was computed. Beyond statistical significance, the standardized effect sizes provided insight into the magnitude and clinical relevance of the intervention effects. Confidence intervals for all Hedges' *g* estimates were derived using cluster bootstrap resampling at the participant level (2,000 resamples). Effects are considered statistically significant when the 95% bootstrap confidence interval excludes zero.

The full LMM applied in this research included the fixed effects of baseline score, intervention group status, and follow-up time in weeks. The model also accounted for repeated measures over time, including participant-level random intercepts to capture individual differences in initial status. Once the parameters were estimated using restricted maximum likelihood, marginal effects were examined. For each fixed effect, regression coefficients (β) and 95% confidence intervals (CIs) are reported. A *p*-value less than 0.05 (two-tailed) was considered statistically significant. The LMM analyses were conducted using R software version 4.5.1 with the lme4 (Bates et al., 2015) and emmeans (Lenth, 2023) packages.

Results

Characteristics of Participants and Flow

Eligibility assessment occurred for 58 college students at high risk of IGD. Five were excluded for not meeting the eligibility criteria (four did not meet the age criterion, one did not meet the IGD criterion) and two did not respond. Five other participants declined to participate, leaving 46 participants eligible for study assignment; 24 were assigned to MBCT-G and 22 were assigned to the control group. No participants dropped out of either group, and all participants in the intervention group completed the eight sessions of MBCT-G. All participants completed questionnaires at T0, T1, and T2. See Fig. 1 for the CONSORT diagram.

Participants' baseline characteristics are provided in Table 2. No significant differences between the intervention and control groups were found regarding demographic characteristics and outcomes at baseline. More than half of the participants were male (intervention: 58.33%, control: 59.09%). The average age was 21.54 ($SD = 1.53$) for the intervention group and 22.05 ($SD = 1.65$) for the control group. All participants in both groups were never married. Most participants in both groups (intervention: 95.83%, control: 90.91%) lived in metropolitan cities, and more than half to three quarters were not employed (intervention: 58.33%, control: 77.27%). More than half of the participants (intervention: 58.33%, control: 59.09%) majored in social sciences and humanities. Their educational experience varied, ranging from first year to fourth year. Average hours spent on gaming per week were 28.08 ($SD = 11.59$) in the intervention group and 24.82 ($SD = 20.90$) in the control group. Mean scores for primary and secondary outcome measures per time point are shown in Table 3. As previously noted, participants' outcomes did not differ between the intervention and control groups.

Primary Outcome: Internet Gaming Disorder

The results of LMM analyses for the intervention condition, time effects, and their interactions are shown in Table 4. The estimated changes in IGD scores from T0 to T1 and T2 are presented in Fig. 2. Time effects were significant at both T1 ($p < 0.001$) and T2 ($p < 0.001$), indicating that IGD scores declined across time in both the intervention and control groups. In addition, statistically significant group-by-time interactions were observed for IGD at T1 ($p < 0.05$) and T2 ($p < 0.001$), indicating greater reductions in IGD symptoms in the MBCT-G group relative to the control group from T0 to T1 and from T0 to

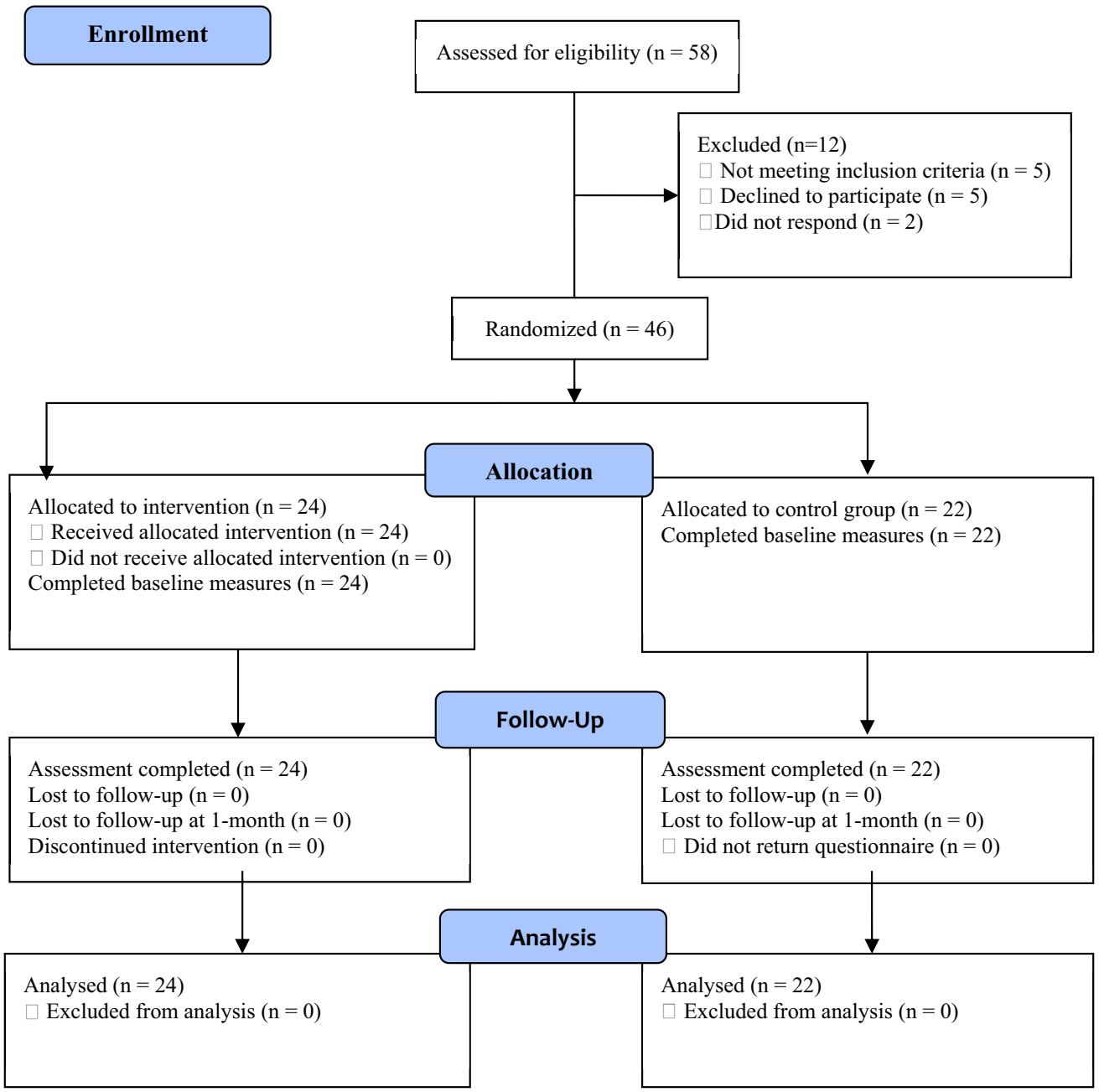

Fig. 1 CONSORT (Consolidated Standards of Reporting Trials) flow diagram of the MBCT-G pilot study

T2. The standardized effect was significant and large at T1 ($g = -1.06$; 95% CI [−1.95, −0.27]) and T2 ($g = -1.51$; 95% CI [−2.56, −0.63]). As shown in Fig. 2, the MBCT-G group showed a sharper and more sustained reduction in IGD symptoms relative to the control group.

Secondary Outcomes

Time effects and group effects alone were not significant for all secondary outcomes. Statistically significant group-by-time interactions were observed for perceived stress at T1 ($p < 0.05$) and T2 ($p < 0.05$), self-control at T1 ($p < 0.01$) and T2 ($p < 0.001$), and state anxiety at T1 ($p < 0.05$). In contrast, no statistically significant group-by-time interaction was observed for impulsivity, depressive symptoms, and trait anxiety. These findings indicate that the MBCT-G group, compared with the control group, showed greater decreases in stress and anxiety and greater increases in self-control from T0 to T1 and from T0 to T2. The standardized effect was significantly large for self-control at

Table 2 Baseline characteristics of the participants ($n=46$)

Variable	Total ($n=46$)	Intervention ($n=24$)	Control ($n=22$)		
	n (%) or $M \pm SD$	n (%) or $M \pm SD$	n (%) or $M \pm SD$	χ^2, t, or U	p
Age	21.78 ± 1.59	21.54 ± 1.53	22.05 ± 1.65	215.50	0.28
Gender				0.00	0.96
Male	27 (58.70)	14 (58.33)	13 (59.09)		
Female	19 (41.30)	10 (41.67)	9 (40.91)		
Marital status				NA	NA
Never married	46 (100)	24 (100)	22 (100)		
Married	0 (0)	0 (0)	0 (0)		
Residential area				0.46	0.50
Metropolitan city	43 (93.48)	23 (95.83)	20 (90.91)		
Rural area	3 (6.52)	1 (4.17)	2 (9.09)		
Employment				1.87	0.17
Employed part-time	15 (32.61)	10 (41.67)	5 (22.73)		
Not employed	31 (67.39)	14 (58.33)	17 (77.27)		
Major				0.00	0.96
Social sciences and humanities	27 (58.70)	14 (58.33)	13 (59.09)		
Science, engineering, and medicine	19 (41.30)	10 (41.67)	9 (40.91)		
Educational year				0.81	0.37
1–2	22 (47.83)	13 (54.17)	9 (40.91)		
3–4	24 (52.17)	11 (45.83)	13 (59.09)		
Hours spent on gaming (per week)	26.52 ± 16.59	28.08 ± 11.59	24.82 ± 20.90	185.00	0.08

Table 3 Observed means and standard deviations per time point and intervention condition

Variable	T0				T1		T2	
	Intervention	Control			Intervention	Control	Intervention	Control
	M (SD)	M (SD)	t	p	M (SD)	M (SD)	M (SD)	M (SD)
IGD	69.25 (7.06)	68.55 (9.48)	0.288	0.775	51.33 (14.96)	60.32 (13.86)	45.67 (14.54)	58.86 (15.70)
Impulsivity	47.25 (5.80)	47.59 (9.31)	−0.147	0.884	44.46 (7.65)	46.32 (10.28)	43.96 (7.02)	45.86 (10.20)
Depressive symptoms	15.29 (9.76)	21.23 (15.33)	−1.550	0.130	8.25 (8.01)	18.27 (17.30)	10.54 (9.64)	18.82 (15.78)
Perceived stress	21.42 (4.40)	21.09 (6.38)	0.203	0.840	17.58 (4.74)	20.73 (6.73)	17.00 (6.45)	20.14 (7.09)
Trait anxiety	47.71 (7.28)	51.00 (10.78)	−1.203	0.237	43.04 (9.70)	49.32 (11.00)	43.75 (11.83)	49.59 (11.55)
State anxiety	46.79 (8.14)	47.91 (11.75)	−0.372	0.712	40.17 (9.90)	46.64 (12.07)	42.96 (13.35)	46.95 (12.59)
Self-control	26.88 (6.26)	28.95 (9.13)	−0.907	0.369	33.13 (9.28)	28.55 (8.36)	33.42 (9.46)	28.00 (10.42)

Time points: T0 preintervention; T1 postintervention; T2 4 weeks postintervention

IGD internet gaming disorder

T1 ($g=1.21$; 95% CI [0.44, 2.00]) and T2 ($g=1.36$; 95% CI [0.62, 2.21]); stress at T1 ($g=-0.87$; 95% CI [−1.79, −0.05]); and state anxiety at T1 ($g=-0.90$; 95% CI [−1.65, −0.14]). Estimated changes in secondary outcomes from T0 to T1 and T2 are presented in Fig. 3. Outcomes with significant interaction effects—perceived stress, state anxiety, and self-control—displayed diverging lines between groups over time. By contrast, outcomes with nonsignificant interactions exhibited parallel trajectories.

Discussion

This study examined the effects of MBCT-G on IGD symptoms and broader mental health indicators among college-aged students at risk for problematic gaming using LMM. This study was significant as the first empirical evaluation of MBCT specifically adapted to address IGD symptoms among college-aged students, who are

Table 4 Linear mixed models of intervention effects for MBCT-G

Outcome measures	Estimate	*SE*	*p*
IGD			
(Intercept)	68.55	2.77	0.000
Group	0.71	3.83	0.854
Time (T1)	−8.23	2.72	0.003
Time (T2)	−9.68	2.72	0.000
Time (T1) × Group (intervention)	−9.69	3.77	0.010
Time (T2) × Group (intervention)	−13.90	3.77	0.000
Impulsivity			
(Intercept)	47.59	1.81	0.000
Group	−0.34	2.50	0.892
Time (T1)	−1.27	1.24	0.306
Time (T2)	−1.73	1.24	0.164
Time (T1) × Group (intervention)	−1.52	1.72	0.377
Time (T2) × Group (intervention)	−1.56	1.72	0.363
Depressive symptoms			
(Intercept)	21.23	2.77	0.000
Group	−5.94	3.83	0.121
Time (T1)	−2.96	2.22	0.184
Time (T2)	−2.41	2.22	0.278
Time (T1) × Group (intervention)	−4.09	3.08	0.184
Time (T2) × Group (intervention)	−2.34	3.08	0.447
Perceived stress			
(Intercept)	21.09	1.28	0.000
Group	0.33	1.78	0.855
Time (T1)	−0.36	1.19	0.760
Time (T2)	−0.96	1.19	0.422
Time (T1) × Group (intervention)	−3.47	1.65	0.035
Time (T2) × Group (intervention)	−3.46	1.65	0.035
Trait anxiety			
(Intercept)	51.00	2.23	0.000
Group	−3.29	3.08	0.285
Time (T1)	−1.68	1.63	0.303
Time (T2)	−1.41	1.63	0.388
Time (T1) × Group (intervention)	−2.99	2.26	0.187
Time (T2) × Group (intervention)	−2.55	2.26	0.259
State anxiety			
(Intercept)	47.91	2.43	0.000
Condition	−1.12	3.37	0.740
Time (T1)	−1.27	1.77	0.472
Time (T2)	−0.96	1.77	0.590
Time (T1) × Group (intervention)	−5.35	2.45	0.029
Time (T2) × Group (intervention)	−2.88	2.45	0.240
Self-control			
(Intercept)	28.96	1.90	0.000
Group	−2.08	2.63	0.428
Time (T1)	−0.41	1.63	0.802
Time (T2)	−0.96	1.63	0.558
Time (T1) × Group (intervention)	6.66	2.26	0.003
Time (T2) × Group (intervention)	7.50	2.26	0.001

IGD internet gaming disorder

recognized as particularly vulnerable to internet gaming-related problems. Results indicated that relative to the control group, participation in the MBCT-G intervention led to significant postintervention reductions in IGD symptoms, which were sustained at the 1-month follow-up assessment. These results may indicate that the intervention accounted for a significant portion of the observed improvement, suggesting that MBCT-G may constitute a promising, evidence-based approach to reducing IGD symptoms among college-aged students. The study findings were consistent with previous research showing that the combined approach of mindfulness and CBT was the most effective for excessive gaming (Kim et al., 2022a, b; Li et al., 2017), and further supported the potential therapeutic effectiveness of MBCT-G. Beyond statistical significance, the standardized effect sizes provided insight into the magnitude and clinical relevance of the intervention effects. Compared with recent meta-analytic evidence, our findings place the IGD effects at the upper end of the reported distribution. Byeon (2025) reported a pooled Hedges' g of 0.56 for noninvasive interventions targeting IGD, reflecting a moderate average reduction in symptoms across 11 randomized controlled trials, with psychotherapy-based interventions approaching $g \approx -1.34$ in treatment-focused samples. In the present study, IGD demonstrated large effects at postintervention and even larger effects at follow-up, exceeding the pooled meta-analytic estimate and aligning with the strongest effects observed in intensive CBT-based interventions.

MBCT may reduce IGD symptoms among college-aged students through several key mediating mechanisms, including nonjudgmental attitudes and decentering, improved attentional control, and enhanced emotional regulation, which may in turn promote greater self-control (Dragland, 2015; Li et al., 2018; Segal et al., 2013; Sharma et al., 2021; Teasdale et al., 2000). Participants were guided to engage in mindfulness practices that may reduce compulsive gaming by strengthening response inhibition and decreasing cue-reactivity to gaming-related stimuli, thereby reducing craving (Garland et al., 2014; Luo et al., 2025; Tapper, 2018). Through guided mindfulness practices during intervention sessions and closely supervised and monitored home practice, participants have the potential to shift from reactive engagement with gaming urges toward mindful observation and more skillful responses, such as engaging in alternative pleasurable activities and thereby replacing gaming with rewarding nongaming activities (Garland, et al., 2014; Garland & Howard, 2018; Jin et al., 2025).

Although this study focused on college-aged students, a group with high risk, future studies should examine the intervention's applicability to other populations. Findings indicated a need to study the intervention with a larger sample, more diverse populations, and active control

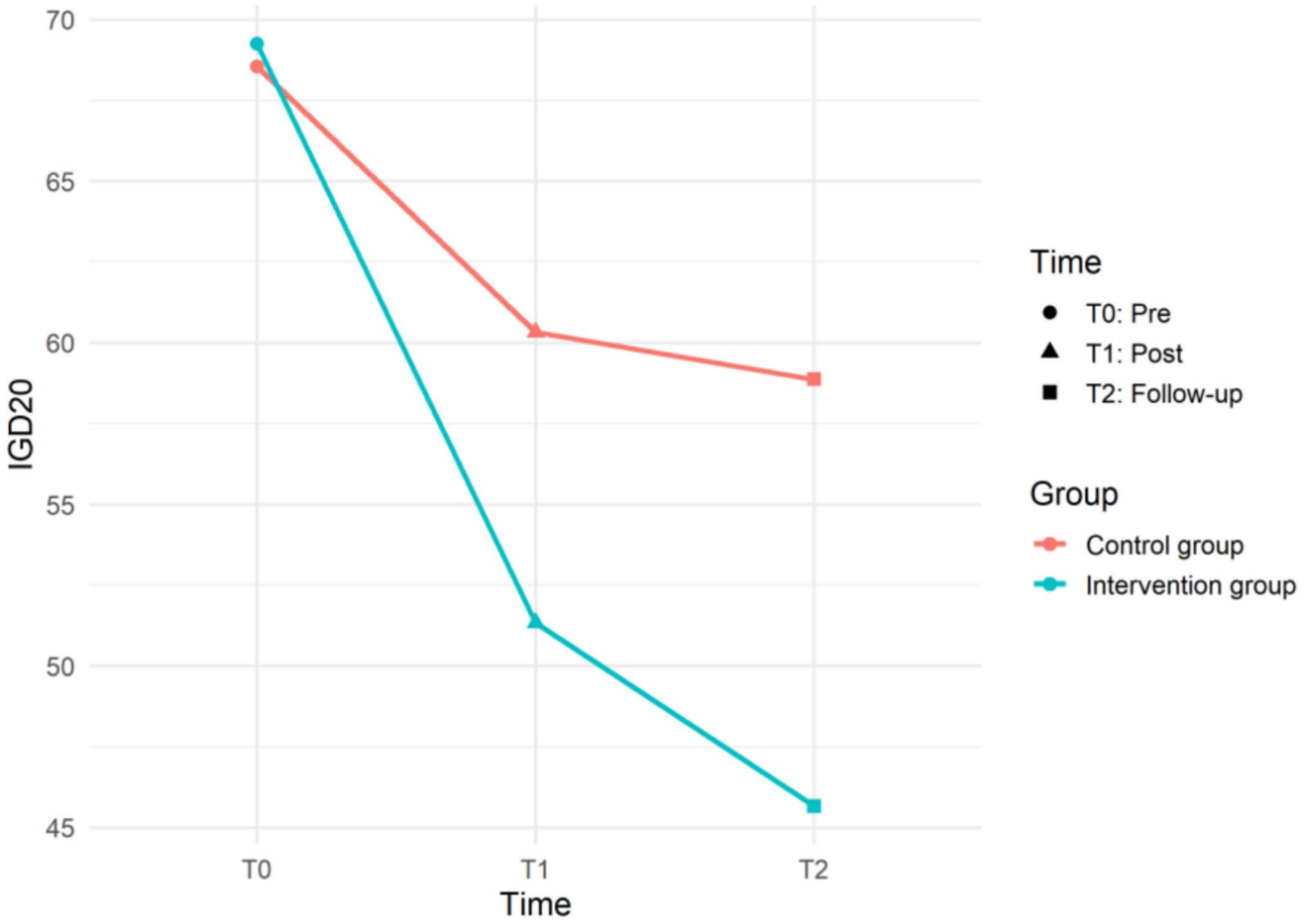

Fig. 2 Estimated changes using LMM in internet game disorder

conditions to enhance methodological rigor and increase the generalizability and applicability of the intervention.

Compared to the control group, participants in the MBCT-G group demonstrated significant improvements in self-control, a core psychological mechanism underlying risk factors and behavioral regulation among individuals with IGD (Fong et al., 2024; Hyun et al., 2015; Jeong et al., 2020; Kim et al., 2008; Rho et al., 2018; Xiang et al., 2022; Yu et al., 2021). Participants in the MBCT-G group may have developed greater awareness of their cravings and habitual addictive behavior to gaming-related triggers, enabling them to respond to such cues more skillfully. This adaptive response appears to have been moderated by improvements in self-control capacity cultivated through the intervention (Fong et al., 2024; Yu et al., 2021). Therefore, self-control may serve as a key explanatory mechanism underlying the association between IGD and its related risk factors among college-aged students.

These results underscored the importance of incorporating intervention components that enhance self-control, thereby disrupting reactive behavioral pathways and ultimately reducing IGD symptomatology. Future studies should examine the mechanisms through which self-control mediates the effects of MBCT-G on IGD symptoms. Although previous literature found a negative association between self-control and online gaming disorder among early adult gamers (Safarina & Halimah, 2019), mixed findings were recently reported in different age groups (Hu et al., 2025). Future studies should investigate whether MBCT-G's effects on self-control develop over time and shape individuals' varying life trajectories.

Participants in the MBCT-G group demonstrated greater reductions in perceived stress compared with those in the control group at both posttreatment and 1-month follow-up assessments. These findings suggested that MBCT-G may have facilitated alleviation of stress, one of the core psychological vulnerabilities implicated in the onset and maintenance of IGD (Canale et al., 2019; Lin et al., 2021; Rajab et al., 2020; Yen et al., 2019). College students were particularly vulnerable to diverse stressors due to the transition to emerging adulthood (Byrd & McKinney, 2012; Cameron & Rideout, 2022). Given previous findings that showed MBCT

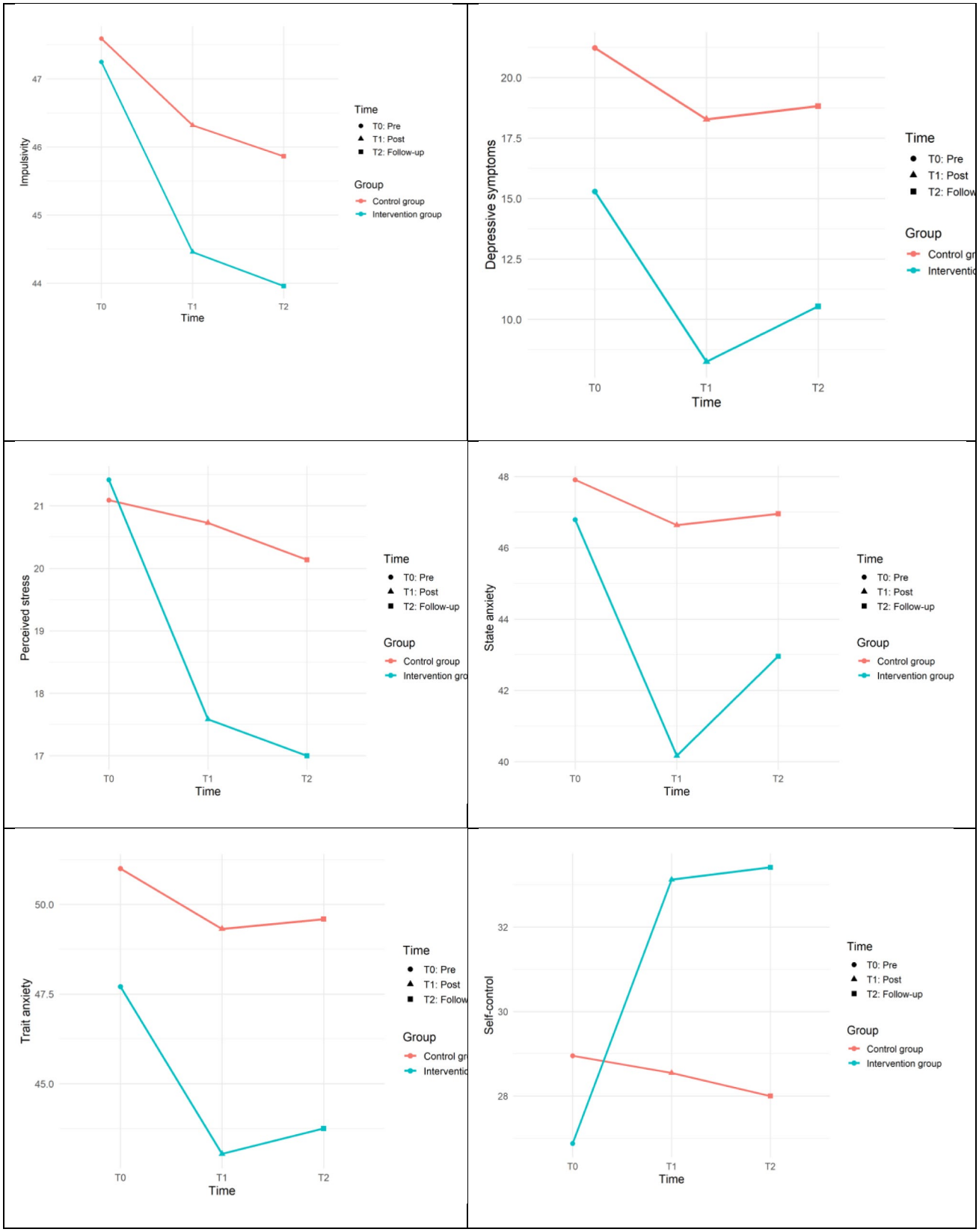

Fig. 3 Estimated changes using LMM in secondary outcomes

reduced perceived stress (Chacko et al., 2022; Phang et al., 2016; Querstret et al., 2020; Strauss et al., 2021), MBCT-G may exert beneficial effects on perceived stress in this population. MBCT likely facilitates improved stress management through core mindfulness mechanisms such as cognitive decentering and nonreactivity to stressors (Davis et al., 2024).

Furthermore, participants in the MBCT-G program were systematically encouraged to engage in alternative pleasurable activities beginning in Week 2 and continuing throughout the intervention period. Prior research has demonstrated that engagement in positive and enjoyable activities can effectively reduce perceived life stress (Bono et al., 2013) and elicit positive emotional states both during and following stressful experiences (Monfort et al., 2015). In line with these findings, participants in the MBCT-G group consistently reported increased involvement in physical and pleasurable activities outside of gaming immersion. This behavioral shift represents a core component of the MBCT-G intervention, not only by reducing excessive gaming behaviors through behavioral substitution but also by enhancing participants' resilience and adaptive capacity in responding to daily stressors and challenges.

In contrast, outcomes such as depressive symptoms and impulsivity were not significantly improved compared to the control group, suggesting that these broader positive changes may reflect general recovery or nonspecific program benefits rather than intervention-specific effects. It is possible that participation in the 8-week MBCT-G program may not have been sufficient to produce significant improvements in affective symptoms, contrary to the secondary study hypothesis. However, this finding needs to be interpreted in consideration of the study population's characteristics. The participants represented a nonclinical or subclinical population who did not exhibit clinically significant levels of depression or impulsive behaviors at baseline. Given the absence of pronounced affective disturbance, MBCT-G may have had limited potential to yield substantial reductions in mood and impulsivity symptoms.

Participants in the MBCT-G program showed a significant reduction in state anxiety at the posttest assessment. However, this effect was attenuated at the follow-up. No significant changes in trait anxiety were observed at the posttest and follow-up assessments. This may be explained by the timing of the assessments—participants completed the posttest assessment at the end of the winter break, whereas the follow-up occurred during the middle of the spring semester, when academic demands may have increased their anxiety. Anxiety may be more sensitive to fluctuating contextual stressors among college-aged students, which may have contributed to the partial rebound observed at follow-up.

Furthermore, although MBCT-G might effectively reduce state anxiety in the short term, sustained practice is often required to achieve long-term reductions in trait anxiety. Previous research has demonstrated that time-limited MBCT can yield meaningful improvements in depression, anxiety, and impulsivity in nonclinical or subclinical populations, although these effects are typically smaller than those observed in clinical samples (Cavanagh et al., 2018; Marchant et al., 2021). This likely depends on continued mindfulness practice and skill maintenance over time. Previous MBCT trials have typically evaluated relapse prevention and symptom maintenance for follow-up periods of 6–12 months or longer, suggesting that extended follow-up is necessary to evaluate sustained effects (Huijbers et al., 2015). The short intervention period and duration of sustained practice may have been insufficient to evaluate adequately the effects of MBCT on depressive symptoms and impulsivity and may have contributed to the partial rebound observed at follow-up in participants' trait anxiety.

Moreover, previous research has suggested that the sustained effects of MBCT on affective disorders are associated with changes in disengagement coping (Cousin & Crane, 2016) and reductions in perseverative thinking (Cavanagh et al., 2018). However, MBCT-G as implemented in the present study primarily emphasizes cultivating mindful awareness of gaming-related urges and habitual patterns. By helping participants observe cravings and urges with nonjudgmental attention and decenter from them, the intervention aims to promote more skillful responses rather than automatic engagement in gaming, while supporting behavioral regulation processes related to gaming behavior and self-control. Given these targets, it is not surprising that improvements in IGD symptoms and self-control had greater stability than those observed for other outcomes.

Future research should therefore examine the effects of MBCT-G among individuals who present with both IGD and clinically elevated mood, anxiety, and impulsive behavior symptoms to evaluate whether the intervention exerts a stronger therapeutic benefit for comorbid affective conditions and targeted reduction of IGD symptoms. Given that the MBCT-G intervention was developed as a cost-effective strategy for college settings, where mental health services often face limitations in staffing and funding, further exploration of its potential benefits for broader mental health problems such as depression and anxiety would be valuable. Moreover, implementing MBCT-G in university counseling centers may help institutions expand their capacity to deliver evidence-based interventions to larger student populations that experience not only gaming-related problems but also other psychological and mental health challenges (Fu & Cheng, 2017).

Limitations and Future Directions

Although this study had certain strengths, including an experimental design with psychometrically sound measures,

it also had significant limitations. First, the sample may have been biased and results might lack generalizability due to the following reasons. The study participants were self-screened for eligibility based on their availability to attend the 8-week session schedule during their college break, which can lead to bias toward those with more available time and higher economic status. Second, given the potential relevance of MBCT theories, this study did not examine mediational mechanisms underlying the reduction of IGD symptoms. Future studies are warranted to include evidence-based measures and conduct mediational analyses to better understand the mechanisms of change through which MBCT may help individuals reduce IGD symptoms. Third, participants' motivation for treating IGD was not assessed at baseline. Their motivation could have affected their postintervention and follow-up changes, making it difficult to rule out the possibility of motivation contributing to outcome effects. Future studies should consider motivation to reduce or treat IGD as a significant moderator variable.

Fourth, this study relied primarily on self-report questionnaires that assessed gaming time and symptoms of IGD, which may have introduced response bias. Although validated instruments were adopted to enhance measurement reliability, the reliance on self-report limits the objectivity of study findings. In future studies, it is necessary to consider objective measures such as digital usage logs and clinician-administered assessments to improve measurement accuracy and reduce potential bias. Furthermore, we recruited participants at high risk of IGD rather than individuals with a formal clinical diagnosis of IGD. Future studies should conduct more rigorous diagnostic procedures, such as structured clinical interviews, to improve the rigor of the research design.

Fifth, this study did not blind the participants to the intervention due to the nature of the study design. As a result, participants in the intervention group may have been aware of the study's therapeutic goals, which could have influenced their responses. In particular, participants in the intervention may have experienced social desirability bias, making them feel obligated to report reduced gaming behaviors. In addition, future studies should be designed with greater methodological rigor by providing an active or benign intervention for the control group. Providing a structured comparison condition would help control nonspecific treatment effects including attention, expectancy, and group support. Sixth, this study involved a relatively small sample size, which may limit the generalizability of the findings. Future studies with larger and more diverse samples are needed to enhance the generalizability and robustness of the findings. Seventh, the study involved a short follow-up period. In particular, although the intervention lasted for 8 weeks, the follow-up assessment was conducted only 4 weeks after the completion of the intervention. A longer follow-up period is warranted to examine the long-term maintenance of MBCT-G outcomes in this study population. Future studies should include extended follow-up assessments to evaluate more adequately the durability and stability of treatment effects. Eighth, the intervention was conducted at a single site, which may have resulted in larger treatment effects of the intervention due to more rigorous control. However, multisite studies should be conducted to enhance the generalizability of the intervention.

Finally, the 8-week MBCT-G intervention was delivered by the principal investigator, who had received extensive education, training, and supervised clinical experience directly from the developers of MBCT-L, the foundational model from which the MBCT-G protocol was adapted to treat IGD. As a result, the study outcomes may have been influenced by the instructor's advanced expertise and high treatment fidelity, potentially limiting the generalizability of the findings to settings in which less experienced practitioners are likely to deliver the intervention. Future research should recruit and train additional MBCT-G instructors to evaluate the replicability and effectiveness of the intervention regarding both primary and secondary outcomes across diverse practitioners and implementation contexts.

Conclusion

This pilot study provided the first empirical evaluation of MBCT-G in reducing IGD symptoms, improving self-control, and decreasing perceived stress and state anxiety among college-aged students, who are particularly vulnerable to internet gaming-related problems. Findings preliminarily suggest that MBCT-G may effectively target both the behavioral and psychological mechanisms underlying IGD, particularly by enhancing self-control capacity and stress resilience. Cultivating mindful awareness and decentering may help individuals disengage from automatic reactivity to cravings and stressors, thereby supporting more adaptive regulation of gaming-related urges. Given its structured, low-cost, and group-based format, MBCT-G is a promising evidence-informed approach suitable for implementation in college counseling centers. Broader dissemination of MBCT-G could contribute to addressing IGD-related problems prevalent among college-aged students, promoting self-regulation capacity, psychological well-being, and adaptive functioning across diverse educational and clinical contexts.

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Author Contributions Anderson Yoon: conceptualization, methodology, investigation, writing—original draft, writing—reviewing and editing. Yehwi Park: formal analysis, investigation, writing—original draft, project administration. Min Ah Kim: conceptualization, methodology, writing—original draft, writing—reviewing and editing. I-ming Chiu: methodology, formal analysis, visualization, original draft preparation. Phyllis Solomon: writing—reviewing and editing. Seog Ju Kim: conceptualization, writing—reviewing and editing. Hayoung Oh: conceptualization, investigation, funding acquisition. Willem Kuyken: writing—reviewing and editing.

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Data Availability The data are not publicly available due to privacy.

Declarations

Ethics Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Ethical approval was obtained from the institutional review board of the Sungkyunkwan University (SKKU-2024-12-023).

Informed Consent Informed consent was obtained from all individual participants included in the study.

Competing interests The authors declare no competing interests.

Use of Artificial Intelligence Artificial intelligence tools were used for editing the manuscript to improve the English language. All AI-generated outputs were rigorously reviewed and verified by the authors for accuracy.

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